WHAT IS CLAIMED IS:

1. A method of optimally designing a structure comprising a step of obtaining a solution of a structure optimal designing problem, formulated as a dual optimization problem having a first solution process to solve an optimization problem of a first evaluation functional for a status variable vector and a design variable vector and a second solution process to solve an optimization problem of a second evaluation functional for said status variable vector and said design variable vector,

wherein when said status variable vector is a displacement in each node, and said design variable vector is an existence ratio of a structural member in each element,

said first solution process including said second solution process as one step, and further including a design variable update step of reading said design variable vector and said status variable vector stored in a first storage unit, updating said design variable vector, and storing the updated design variable vector into said first storage unit, and

said second solution process including a status variable update step of reading said design variable vector and said status variable vector stored in a second storage unit, updating said status variable vector, and storing the updated status variable vector

into said second storage unit, wherein said second evaluation function at said second solution process comprises a norm of residual vector, and said status variable vector is not initialized upon start of said second solution process.

2. The method according to claim 1, wherein at said first solution process, any one of a sequential linear programming method, an optimality criteria method, and a sequential convex function approximate method is executed.

3. The method according to claim 1, wherein at said second solution process, any one of a conjugate residual method, a GCR method, a GCR(k) method, an Orthomin(k) method, a GMRES(k) method and their derivative methods is executed.

4. A method of optimally designing a structure comprising a step of obtaining a solution of a structure optimal designing problem, formulated as a dual optimization problem having a first solution process to solve an optimization problem of a first evaluation functional for a status variable vector and a design variable vector and a second solution process to solve an optimization problem of a second evaluation functional for said status variable vector and said design variable vector,

wherein when said status variable vector is a displacement in each node, and said design variable

vector is an existence ratio of a structural member in each element,

said first solution process including said second solution process as one step, and further including a design variable update step of reading said design variable vector and said status variable vector stored in a first storage unit, updating said design variable vector, and storing the updated design variable vector into said first storage unit, and

said second solution process comprising a conjugate gradient method, and including a preconditioning step of executing preconditioning on a nodal force vector based on a global stiffness matrix, and a status variable update step of reading said design variable vector and said status variable vector stored in a second storage unit, updating said status variable vector, and storing the updated status variable vector into said second storage unit, wherein said status variable vector is not initialized upon start of said second solution process.

5. The method according to claim 4, wherein at said first solution process, any one of a sequential linear programming method, an optimality criteria method, and a sequential convex function approximate method is performed.

6. The method according to claim 4, wherein at said preconditioning step, a component in a row or column of

the nodal force vector is set to 0 when a diagonal component in the corresponding row or column of the global stiffness matrix becomes 0.

7. An information processing apparatus for optimally designing a structure by obtaining a solution of a structure optimal designing problem, formulated as a dual optimization problem having a first solution process to solve an optimization problem of a first evaluation functional for a status variable vector and a design variable vector and a second solution process to solve an optimization problem of a second evaluation functional for said status variable vector and said design variable vector, wherein said status variable vector is a displacement in each node, and said design variable vector is an existence ratio of a structural member in each element, said apparatus comprising:

first solution module adapted to execute said first solution process, and including design variable update means for reading said design variable vector and said status variable vector stored in a first storage unit, updating said design variable vector, and storing the updated design variable vector into said first storage unit; and

second solution module adapted to execute said second solution process during said first solution process, and including status variable update means for reading said design variable vector and said status

variable vector stored in a second storage unit, updating said status variable vector, and storing the updated status variable vector into said second storage unit,

wherein said second solution module uses a norm of residual vector as said second evaluation function, and said status variable vector is not initialized upon start of processing by said second solution module.

8. The information processing apparatus according to claim 7, wherein said first solution module performs any one of a sequential linear programming method, an optimality criteria method, and a sequential convex function approximate method.

9. The information processing apparatus according to claim 7, wherein said second solution module performs any one of a conjugate residual method, a GCR method, a GCR(k) method, an Orthomin(k) method, a GMRES(k) method and their derivative methods.

10. An information processing apparatus for optimally designing a structure by obtaining a solution of a structure optimal designing problem, formulated as a dual optimization problem having a first solution process to solve an optimization problem of a first evaluation functional for a status variable vector and a design variable vector and a second solution process to solve an optimization problem of a second evaluation functional for said status variable vector and said

design variable vector, wherein said status variable vector is a displacement in each node, and said design variable vector is an existence ratio of a structural member in each element, said apparatus comprising:

first solution module adapted to execute said first solution process, and including design variable update means for reading said design variable vector and said status variable vector stored in a first storage unit, updating said design variable vector, and storing the updated design variable vector into said first storage unit; and

second solution module adapted to execute said second solution process by a conjugate gradient method during said first solution process, and including preconditioning means for performing preconditioning on a nodal force vector based on a global stiffness matrix, and status variable update means for reading said design variable vector and said status variable vector stored in a second storage unit, updating said status variable vector, and storing the updated status variable vector into said second storage unit,

wherein said status variable vector is not initialized upon start of processing by said second solution means.

11. The information processing apparatus according to claim 10, wherein said first solution module performs any one of a sequential linear programming method, an

optimality criteria method, and a sequential convex function approximate method.

12. The information processing apparatus according to claim 10, wherein said preconditioning means sets a component in a row or column of the nodal force vector to 0 when a diagonal component in the corresponding row or column of the global stiffness matrix becomes 0.

13. A program to be executed by an information processing apparatus for optimally designing a structure, and comprising a module of obtaining a solution of a structure optimal designing problem, formulated as a dual optimization problem having a first solution process to solve an optimization problem of a first evaluation functional for a status variable vector and a design variable vector and a second solution process to solve an optimization problem of a second evaluation functional for said status variable vector and said design variable vector, wherein said status variable vector is a displacement in each node, and said design variable vector is an existence ratio of a structural member in each element, said module comprising:

first solution module adapted to execute said first solution process, and including design variable update step of reading said design variable vector and said status variable vector stored in a first storage unit, updating said design variable vector, and storing

the updated design variable vector into said first storage unit; and

second solution module adapted to execute said second solution process during said first solution process, and including status variable update step of reading said design variable vector and said status variable vector stored in a second storage unit, updating said status variable vector, and storing the updated status variable vector into said second storage unit,

wherein said second solution module uses a norm of residual vector as said second evaluation function, and said status variable vector is not initialized upon start of processing by said second solution module.

14. A program to be executed by an information processing apparatus for optimally designing a structure, and comprising a module of obtaining a solution of a structure optimal designing problem, formulated as a dual optimization problem having a first solution process to solve an optimization problem of a first evaluation functional for a status variable vector and a design variable vector and a second solution process to solve an optimization problem of a second evaluation functional for said status variable vector and said design variable vector, wherein said status variable vector is a displacement in each node, and said design variable vector is an existence ratio

of a structural member in each element, said module comprising:

first solution module adapted to execute said first solution process, and including design variable update step of reading said design variable vector and said status variable vector stored in a first storage unit, updating said design variable vector, and storing the updated design variable vector into said first storage unit; and

second solution module adapted to execute said second solution process by a conjugate gradient method during said first solution process, and including preconditioning step of performing preconditioning on a nodal force vector based on a global stiffness matrix, and status variable update step of reading said design variable vector and said status variable vector stored in a second storage unit, updating said status variable vector, and storing the updated status variable vector into said second storage unit,

wherein said status variable vector is not initialized upon start of processing by said second solution means.